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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/068,824
Filing Date: February 06, 2002
Appellant(s): ROMANO, CHARLES E.

Lynne M. Blank
For Appellant

MAILED

DEC 2 0 2005

GROUP 1700

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 13, 2005 appealing from the Office action mailed May 11, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is deficient. 37 CFR 41.37(c)(1)(v) requires the summary of claimed subject matter to include: (1) a concise explanation of the subject matter defined in each of the independent claims involved in the appeal, referring to the specification by page and line number, and to the drawing, if any, by reference characters and (2) for each independent claim involved in the appeal and for each dependent claim argued separately, every means plus function and step plus function as permitted by 35 U.S.C. 112, sixth paragraph, must be identified and the structure, material, or acts described in the specification as corresponding to each claimed function

must be set forth with reference to the specification by page and line number, and to the drawing, if any, by reference characters. The brief is deficient because the brief does not contain a concise explanation of the subject matter defined in independent claim 38 and contains conclusive statements that the claimed invention offers better laminate adhesion than the prior art.

Independent claim 38 is directed to an ink recording element comprising a support having thereon a hydrophilic absorbing layer and a laminate adhesion promoting absorbing hydrophilic overcoat polymer layer comprising acetoacetylated polyvinyl alcohol and an anionic vinyl latex polymer or an anionic polyurethane dispersion.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows: The rejection marked as issue 2 by appellants should be a rejection of claim 38 under 35 U.S.C. 103(a) as being unpatentable over Niu et al. (6,599,593) in view of appellants' admission of pages 8-9 of the specification.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,224,971	TOMIZAWA ET AL.	5-2001
6,599,593	NIU ET AL.	7-2003

5,478,631	KAWANO ET AL.	12-1995
EP 791,475	UEDA ET AL.	8-1997

Appellants' admissions of pages 8-9 of the specification.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 38 stands finally rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. With respect to claim 38, the examiner was unable to find support in the original claims or specification for the limitation that the vinyl latex polymer be anionic. Appellants have pointed to several claims and places within the specification, including the examples. There is one example that includes a vinyl latex by tradename, but fails to state or suggest a preference for anionic vinyl latex materials. Consequently, this claim limitation is new matter.

In response, appellants have stated that the "known chemical structure of the compound would be obvious to one or ordinary skill in the chemical formulating art related to ink recording elements." However, appellants have not

supplied the formula of this material and the formulation of tradenamed materials can be modified by the manufacturer. Therefore, in order to support their statements, it is requested that appellants provide evidence of the chemical structure that they are referring to and then amend the specification to incorporate the generic chemical structure into the specification so that this is available to one of ordinary skill in the art. At that time, the examiner will reconsider this rejection based upon evidence that the tradenamed material Morcryl 132 vinyl latex is in fact anionic, in combination with appellants' argument that one of ordinary skill in the art would have found it apparent from the disclosure of this single anionic material and the specific disclosure of anionic polyurethane materials, that the vinyl latex polymers of the invention should also be anionic.

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 9, 11, 12, 15, 21, 22 and 37 stand finally rejected under 35 U.S.C. 102(b) as being anticipated by Kawano et al. (5,478,631). Kawano et

al. disclose an ink jet recording element having a support and top and bottom hydrophilic absorbing layers on its surface. Both top and bottom layer are formed from an aqueous composition including amphoteric latex, water-soluble polymer and pigment (see col. 7, lines 3-21). As water-soluble polymers, the reference discloses one or more of a group including acetoacetylated polyvinyl alcohol, polyvinyl pyrrolidone, and gelatin. The layers may also contain vinyl latexes and polyurethane resin (see col. 6, lines 1-48). The reference discloses layer weight per area as opposed to layer thicknesses (see col. 9, lines 18-24). The bottom layer may be further divided to form an intermediate layer and a lowest layer (see col. 7, lines 52-55). The ink receptive layers may contain a dye-fixing agent, i.e. mordant (see col. 6, lines 48-61). It is noted that the term "laminate adhesion promoting absorbing hydrophilic overcoat polymer latex" has no specific meaning in the art and is largely a series of functions assigned to the layer. Since the top layer of the reference would have each of these properties to some degree, the claimed layer reads on the top layer of the reference.

3. Claims 1-3, 7-15,19-22 and 37 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Kawano et al. (5,478,631). Kawano et al. disclose an ink jet recording element having a support and top and bottom hydrophilic absorbing layers on its surface. Both top and bottom layer is formed from an aqueous composition including amphoteric latex, water-soluble polymer and pigment (see col. 7, lines 3-21). As water-soluble polymers, the reference discloses one or more of a group including acetoacetylated polyvinyl alcohol, polyvinyl pyrrolidone, and gelatin. The layers may also contain vinyl latexes and

polyurethane resin (see col. 6, lines 1-48). The reference discloses layer weight per area as opposed to layer thicknesses (see col. 9, lines 18-24). The bottom layer may be further divided to form an intermediate layer and a lowest layer (see col. 7, lines 52-55). The ink receptive layers may contain a dye-fixing agent, i.e. mordant (see col. 6, lines 48-61).

Since the reference states that the group of binders including polyurethane may be used "as far as the effects of the present invention are not lost," it would have been obvious to one of ordinary skill in the art to use less of these binders than of the water-soluble high polymer, a required component in each layer (see col. 6, lines 33-36). Consequently, the ratio of polyurethane to polyvinyl alcohol instantly claimed would have been obvious to one of ordinary skill in the art. It also would have been obvious to one of ordinary skill in the art to determine thicknesses of the layers based upon the coating weights disclosed by the reference and the performance of the medium in areas of surface strength, bleeding and thinning, color reproduction, and water resistance, i.e. the properties identified by Kawano et al.

4. Claims 1, 2, 4-6 and 37 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Kawano et al. as applied to claims 1-3, 7-15 and 19-22 above, and further in view of Tomizawa et al. (6,224,971) for reasons of record and for reasons given below. The secondary reference discloses an ink jet recording sheet including acetoacetylated polyvinyl alcohol. The primary reference does not disclose the properties of the disclosed acetoacetylated polyvinyl alcohol used therein, therefore, it is appropriate to look elsewhere in the

same art area for a particular acetoacetylated polyvinyl alcohol to use in the invention of the primary reference. Tomizawa et al. disclose an acetoacetylated polyvinyl alcohol with properties as recited by the instant claims (see col. 2, lines 46-67) although the reference is silent with respect to molecular weight. Both appellant and the secondary reference use a commercially available product from the Gohsefimer Z200 series of Nippon Gohsei Kagaku Kogyo Co. The examiner was unable to determine the molecular weights of each of these polymers. However, they are in the same commercial series of the same company, and have the same degree of saponification and substitution. Therefore, it would have been obvious to one of ordinary skill in the art to determine the particular polyvinyl alcohol from the commercially available series of polymers identified by the prior art as useful in ink jet recording media applications in order to achieve the goals set forth by the primary reference.

5. Claims 1 and 15-18 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Kawano et al. as applied to claims 1-3, 7-15, 19-22 above, and further in view of Ueda et al. (EP 791,475) for reasons of record and for reasons given below. As with the polyvinyl alcohol, the primary reference is also silent with respect to particular gelatin that may be used. Therefore, Ueda et al. is cited for teaching of gelatin that is used in the ink jet recording art (see page 3). The secondary reference teaches that gelatins may be pigskin, cow skin, or cow bone, and may be lime-processed, acid processed, or gelatin derivatives. Based upon this teaching it would have been obvious to one of ordinary skill in

the art to use a gelatin previously taught for use in ink jet recording media as the gelatin of the primary reference.

6. Claims 1, 2, 7, 8, 21, 22 and 37 stand finally rejected under 35 U.S.C. 102(e) as being anticipated by Niu et al. (6,599,593). The reference discloses an ink-receiving medium that may be used as an ink jet recording medium (see col. 3, lines 54-58) comprising a substrate, a porous medial layer, and a non-porous top layer on the surface thereof (see the abstract). The top layer may be a combination of an acetoacetylated polyvinyl alcohol, a polyurethane resin dispersion and an epichlorohydrin containing polyamide (see col. 9, lines 6-31). The medial layer may be pigment and polyvinyl alcohol (see col. 16, line 56 to col. 18, lines 24). The layer may also contain a latex resin (see col. 18, lines 25-44). An additional layer may be present between the top layer and the medial layer (see col. 20, lines 30-35). The epichlorohydrin containing polyamide acts as a mordant (see col. 22, line 57 to col. 23, line 28).

7. Claims 1, 2, 9-14, 19-22, 37 and 38 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Niu et al. (6,599,593) for reasons of record and for reasons given below. See paragraph 6 above. The reference discloses coating weights rather than coating thicknesses, however, from the disclosure of coating weights, it would have been obvious to one of ordinary skill in the art to determine coating thicknesses for the layers (see col. 19, lines 28-31and col. 24, lines 35-38). With respect to an additional coat layer between the medial and top layers, since such layers are disclosed by the reference, it would have been obvious to one of ordinary skill in the art to include an additional layer of the

same compositional make up in order to increase the coating thickness while avoiding coating problems, such as cracking, which are associated with coating of a single layer of greater thickness.

8. Claim 38 stands finally rejected under 35 U.S.C. 103(a) as being unpatentable over Niu et al. (6,599,593) in view of appellants' admission of pages 8-9 of the specification for reasons of record and for reasons given below. Appellants admit that polyurethane that may be used in their invention may be Witcobond ® W-232, a commercially available polyurethane dispersion. Based upon the disclosure of the reference that a polyurethane dispersion may be included in the disclosed medium, it would have been obvious to one of ordinary skill in the art to include commercially available polyurethane that is capable of forming part of an aqueous coating composition.

9. Claims 1, 2 and 4-6 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Niu et al. (6,599,593) as applied to claims 1, 2, 7-14, 19-22, 37 and 38 above, and further in view of Tomizawa et al. (6,224,971). The secondary reference discloses an ink jet recording sheet including acetoacetylated polyvinyl alcohol. The primary reference does not disclose the properties of the disclosed acetoacetylated polyvinyl alcohol used therein, therefore, it is appropriate to look elsewhere in the same art area for a particular acetoacetylated polyvinyl alcohol to use in the invention of the primary reference. Tomizawa et al. disclose an acetoacetylated polyvinyl alcohol with properties as recited by the instant claims (see col. 2, lines 46-67) although the reference is silent with respect to molecular weight. Both appellant and the secondary

reference use a commercially available product from the Gohsefimer Z200 series of Nippon Gohsei Kagaku Kogyo Co. The examiner was unable to determine the molecular weights of each of these polymers. However, they are in the same commercial series of the same company, and have the same degree of saponification and substitution. Therefore, it would have been obvious to one of ordinary skill in the art to determine the particular polyvinyl alcohol from the commercially available series of polymers identified by the prior art as useful in ink jet recording media applications in order to achieve the goals set forth by the primary reference.

10. Claims 1 and 15-18 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Niu et al. (6,599,593) as applied to claims 1, 2, 7-14, 19-22, 37 and 38 above, and further in view of Ueda et al. (EP 791,475). As with the polyvinyl alcohol, the primary reference is also silent with respect to particular gelatin that may be used. Therefore, Ueda et al. is cited for teaching of gelatin that is used in the ink jet recording art (see page 3). The secondary reference teaches that gelatins may be pigskin, cow skin, or cow bone, and may be lime-processed, acid processed, or gelatin derivatives. Based upon this teaching it would have been obvious to one of ordinary skill in the art to use a gelatin previously taught for use in ink jet recording media as the gelatin of the primary reference.

(10) Response to Argument

1. With respect to rejection of claim 38 under 35 USC 112, for support of the anionic nature of the vinyl latex polymer, appellants rely on a Product Information sheet for Morcryl®132 from Rohm & Haas, the material used in their Example 4. It is not apparent from the submitted Product Information sheet that Morcryl® 132 is anionic. The provided sheet does not state that the material is anionic nor does it provide the chemical structure of the material. The examiner has asked for further explanation or information about the chemical structure of the tradenamed material, but appellants have provided no further explanation.

The reference to Morcryl® 132 is believed to be the only possible support in appellants' specification for the claimed anionicity of the vinyl latex, although appellants also attempt to rely upon their disclosure of anionic polyurethane latex as support. Without further information or explanation, the rejection is believed to be proper because the claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention, i.e. inclusion of anionic vinyl latex in the overcoat layer.

2-10. The main issue in the remainder of the rejections concerns what weight should be given to the phrase "laminate adhesion promoting absorbing hydrophilic overcoat layer." This phrase is used in the specification and claims

but is not defined. To show that laminate adhesion is well known in the art, appellants have provided ASTM F2226-03.[1] This test is directed to lamination and delamination of a separate film, with or without adhesive, over a printed document (see Section 1.1). It is not directly related to ink recording elements. Ink recording elements do not have a film adhered to the surface because they function to receive ink and cannot do so with a protective film prelaminated to the surface. Therefore, appellants' statements that the prior art is not directed to laminate adhesion and does not deal with laminate adhesion are correct. The prior art is directed to ink recording elements as are appellants' claims.

Appellants argue that the term has special meaning, however, the special meaning appellants wish to attribute to the term does not appear in their specification and would not have been well known to one of ordinary skill in the art. In addition, appellants attempt to rely on experimental examples in their specification and in Declarations to demonstrate that their element is better than the prior art at being "laminate adhesion promoting". All of these experiments have to do with adhering a particular laminating film to the front surface of ink recording elements and then trying to peel it away (see the Laminate Adhesion Test on page 18 of the specification). Thus, the test concerns adhesion of one particular sheet that is identified only by tradename, GBS Octiva Low Melt Gloss laminate. This material has not been further identified.

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[1] It is noted that page 2 of the test appears to be missing from the Appendix to appellants' Brief although page 2 was submitted during prosecution. A full copy of this test, including page 2, has been attached to the Examiner's Answer.

The property of laminate adhesion is not limited to adhesion to one particular film. The claims do not recite a particular laminating film or describe the film to be laminated to the recording element. Since the claims are silent with respect to what is to be laminated, showings that appellants' particular element delaminates with greater peel force from an unclaimed laminate film (described only by its tradename) than the element of the prior art are not persuasive. This is insufficient to show that the prior art is not "laminate adhesion promoting" or to demonstrate that appellants' results are unexpected. The prior art overcoat may be "laminate adhesion promoting" with respect to a different laminating film.

One of ordinary skill in the art of adhesive resins would have a good idea what components to include in an overcoat to improve adhesion to a laminate film. While appellants' overcoat may bond better to the laminate film they have chosen for their examples, it is unlikely that it will bond better with every laminate film. Since the examiner has not been provided the composition of the laminating film used in appellants' examples, unexpected results cannot be determined. It would be expected for acetoacetylated polyvinyl alcohol to bond more strongly to certain films than unmodified polyvinyl alcohol.

2. While none of the references disclose laminate adhesion, it is an inherent property of the laminate when a laminating film is adhered to the overcoat surface. Every overcoat that adheres to the laminate film can be considered to be promoting laminate adhesion to some degree. Niu et al. specifically disclose inclusion of polyurethane dispersions, and suggest use of those commercially available. It would have been obvious to one of ordinary skill in the art to include

any commercially available polyurethane dispersion that meets the limitations set forth by the reference. Since the reference does not state a particular ionicity for the polyurethane, it would have been obvious to use one that is cationic, anionic or non-ionic in the absence of an unexpected result. None has been demonstrated. The amphoteric latex of the reference is not at issue since appellants' claims use "open" claim language. With respect to Control Example 4, Niu et al. disclose that derivatized polyvinyl alcohol and modified polyurethane dispersions are preferred and give unexpectedly effective results (see col. 21, lines 48-60). Therefore, one would expect preferred results using these components. In addition, as set forth above, appellants have not demonstrated unexpected results since their claims are not limited to promotion of laminate adhesion to a particular laminate film.

3. The examiner disagrees with appellants' statements that one of ordinary skill in the art of ink jet recording would have given different meanings to "laminate adhesion" and "adhesion" and also finds unsupported the definitions set forth by appellants on the bottom of page 9 of the Brief. The source of these definitions is unknown. The term laminate adhesion is not one well defined in the art of ink recording. Appellants' claims are directed to a coated support and include no mention of a separate surface film laminated with heat and/or pressure. The first ASTM test, relied upon by appellants to define "laminate adhesion" is so limited. It is actually directed to applied protective films for any printing element, as opposed to the unprinted ink recording element, i.e. a coated support. The second ASTM Test method D3359-02, cited by appellants to define

"adhesion," is even less analogous than the first test method. It is limited to adhesion of materials to metal surfaces and would not be looked to for a definition by one of ordinary skill in the ink recording element art. In addition, contrary to appellant's assertions, the prior art does not use the term "adhesion" to refer to adhesion between the support and the next coated layer only.

Appellants have not provided a basis for treating these terms as independent and distinct from each other. No special meaning has been demonstrated for "laminate adhesion." If a film is laminated to the surface of a coating, it is unclear why laminate adhesion would not be an inherent property of the medium.

4. Kawano et al. do not have to discuss laminate adhesion to meet appellants' claim limitations. This property is inherently present and whether or not the layer promotes adhesion is a matter of degree - for the laminate to stay together the layer must promote adhesion to some extent. Appellants have not demonstrated that their overcoat is better at promoting laminate adhesion than the prior art irrespective of the laminate film. They use only one film that is not identified compositionally. Without the composition of this film, it is impossible to determine whether appellants' results would have been unexpected to one of ordinary skill in the art.

5. Tomizawa et al. is relied upon only for the particulars of the acetoacetylated polyvinyl alcohol. The secondary reference does not have to mention laminate adhesion to be properly combined with the primary reference. As already discussed, appellants have not demonstrated unexpected results.

6. Ueda et al. is relied upon for the particulars of the gelatin. The secondary reference does not have to mention laminate adhesion to be properly combined with the primary reference. As already discussed, appellants have not demonstrated unexpected results.

7 and 8. The overcoat of the recording element of Niu et al. will inherently promote laminate adhesion to some degree. The preferred top layer binders of Niu et al. are acetoacetylated polyvinyl alcohol, polyurethane dispersion and a polyamide rather than the carboxymethyl cellulose appellants would like to use for comparison (see col. 9 of the reference). Since the reference specifically attributes improved results to use of a combination of the three materials set forth above, comparison with this art should include a top layer comprising these three binders. Even if comparison includes these binders, the scope of appellants' showings is not commensurate with the claims since the claims do not recite the laminate film to be used in testing or demonstrating laminate adhesion.

9. Tomizawa et al. is relied upon only for the particulars of the acetoacetylated polyvinyl alcohol. The secondary reference does not have to mention laminate adhesion to be properly combined with the primary reference. As already discussed, appellants have not demonstrated unexpected results.

10. Ueda et al. is relied upon for the particulars of the gelatin. The secondary reference does not have to mention laminate adhesion to be properly combined with the primary reference. As already discussed, appellants have not demonstrated unexpected results.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,
Pamela R. Schwartz

PAMELA R. SCHWARTZ
PRIMARY EXAMINER

Conferees:
Rena Dye
Carol Chaney

Attachment A
USSN 10/068,824

Designation: F 2226 – 03

Standard Practice for Determining the Adhesion of Prints and Laminating Films[1]

This standard is issued under the fixed designation F 2226; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers procedures for printing a document, applying a laminating film and subsequently delaminating. The laminate film is used for encapsulating and mounting prints to preserve them in office and outdoor environments.

1.2 This practice describes procedures for determining the adhesion strength of lamination film when it is applied to black and white and color prints produced by printers, copiers and other reprographic devices.

1.3 This practice can be used to test different laminates with a given set of inks and media or it can be used to evaluate inks and media with a given laminate.

1.4 This practice specifies size of specimens and defines conditions for measurement of peel adhesion at a 180° angle and delamination speed.

1.5 This practice is applicable to constructions where the substrate surface is subject to failure under peel conditions.

1.6 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 *Definitions:*

2.1.1 *high temperature lamination*—lamination at temperature not lower than 80°C (180°F). The maximum applied temperature is 115 to 121°C (240 to 250°F).

2.1.2 *lamination film*—plastic film having an adhesive layer on one side. The film can be glossy, semi-glossy, or matte and contain additives modifying its optical properties. The film usually has a thickness between 25 to 250 μ (1 to 10 mils).

2.1.3 *low temperature lamination*—lamination at room temperature with applied pressure mostly to mounting board using a pressure-sensitive adhesive.

2.1.4 *mounting board*—paperboard, plastic board, or any supporting board, which could be used to display prints.

2.1.5 *printed media*—recording elements used by printers to receive inks or toners. The substrate may be paper, plastic, canvas, fabric, or other ink receptive material. The substrate may, or not, be coated with an ink receptive layer(s).

2.2 *Definitions of Terms Specific to This Standard:*

2.2.1 *adhesion strength of a laminate*—load per unit necessary to remove the laminate from a prescribed surface when measured in accordance with this test method.

2.2.2 *delaminating/debonding*—separation of a laminating film from a printed media.

2.2.3 *kinetic peak*—load per unit presenting the maximum force that occurs during the average time during the peel test. See Fig. 1.

2.2.4 *peel or stripping strength*—the average load per unit width of sample required to separate or peel the laminate from the printed media at the adhered interface at a separation angle of approximately 180° and at a separation rate of preferably 308 mm (12 in.) per minute. It is expressed in Newtons per meter width, grams per inch width, or ounces per inch width.

2.2.5 *root-mean-square (RMS)*—a mathematical treatment of the force data intended to qualify the extent to which the value deviates about its average value.

2.2.6 *static peak*—load per unit presenting the maximum force that occurs during the delay time before starting the peel test. See Fig. 1.

2.2.7 *valley*—load per unit presenting minimum force during the average time under kinetic conditions. See Fig. 1.

3. Summary of Practice

3.1 Coated or uncoated substrate is printed under standard conditions using four primary, three secondary colors and composite black. Eight color strips 2.54 mm wide and one unprinted are generated.

3.2 The prints having eight color strips are conditioned (preferably for 24 h) and subsequently laminated.

3.3 The laminated prints are conditioned (preferably for 24 h), cut into 25.4-mm strips and subsequently delaminated.

3.4 Comparative studies require testing under well-defined conditions.

4. Significance and Use

4.1 The image life of printed media displayed in both typical office and outdoor environments can be extended by lamination or encapsulation. While natural aging is the most reliable method of assessing lamination adhesion, the length of

[1] This practice is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.03 on Research.

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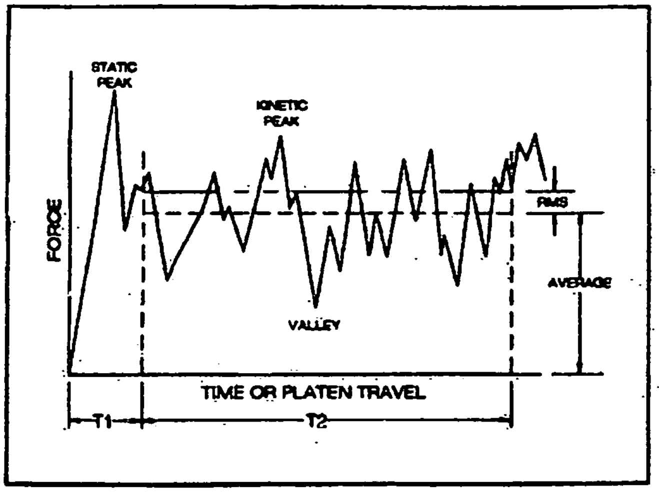

FIG. 1 Data Trace

the time required makes this method impractical for most materials. The peel strength method allows comparative studies of prints and laminating films.

4.2 Good adhesion is prime consideration for laminating films and prints. A laminating film, which does not adhere to a print or vice versa generally, has no commercial value. This method is used to obtain comparative data of peel strength of encapsulated or laminated media.

4.3 Peel strength can be measured up to a point where the peel strength is equal to the tensile strength of the adhesive or the print.

4.4 In many applications, having sufficient laminate adhesion strength is important to give satisfactory performance. The property is also important in determining the uniformity of quality.

4.5 A rough or raspy peel test will produce a higher RMS value than one that is smooth and continuous. It can be related to "zippering," "shocking," or "stick-slip."

4.6 *Bond Strength and Interfacial Adhesion*—The bond strength of a laminate essentially depends on both the adhesive and the cohesive strength of the laminating system. Peel strength of the laminate is typically determined by debonding the laminate using 180° peel test. Fig. 2 presents five possible modes of failure: (*1*) debonding of the ink receptive underlayer from the substrate (*2*) debonding of the ink receptive top layer from the underlayer, (*3*) debonding of the adhesive from the top ink receptive surface, (*4*) debonding the adhesive from the laminating film, (*5*) the substrate or film failure tear. The failure of the laminate will occur at its weakest link. It is generally

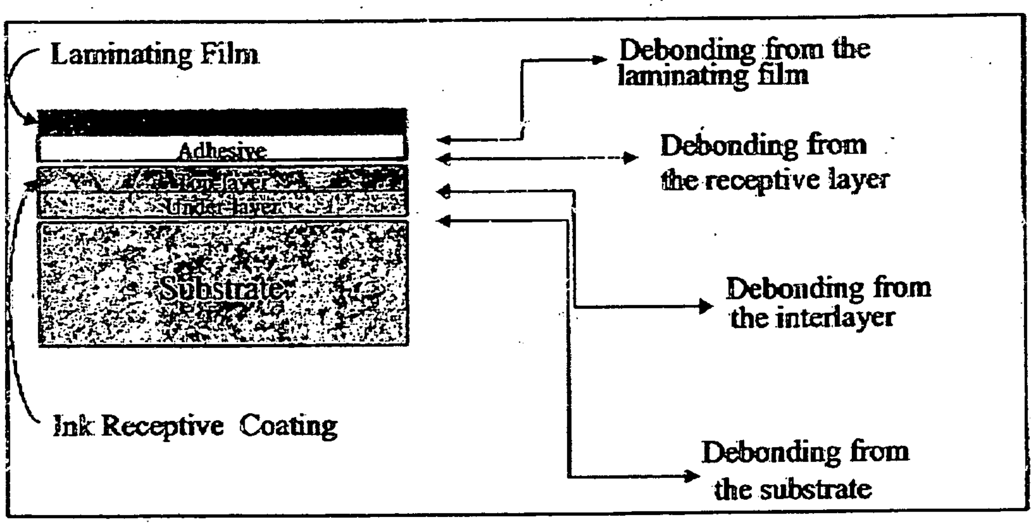

FIG. 2 Modes of Laminate Failure

desirable to have high bond strength to the recording element with failure occurring where the adhesive debonds from the ink receptive.

5. Interferences

5.1 Since the ability of laminating film to adhere to printed media is dependent on temperature and humidity, it is important that lamination be assessed under the conditions appropriate to the end use applications. While printed media may be handled and displayed under a variety of conditions, this test practice is intended to measure peel strength in typical office environments.

5.2 It is recognized that the peel strength of the laminate to the printed media is dependent on toner or ink color, toner or ink load, temperature and relative humidity. Additionally, it is dependent on the substrate, type and coat weight of absorptive layer and the colorant type (dye versus pigment). Consequently, test results must be determined individually for each printed recording media/laminate.

5.3 The peel strength of the laminate is dependent on lamination temperature and should be tested at the manufacturers recommended temperature for the best performance.

5.4 Using a laminating film thicker than 75 μ (3 mil) can create a problem in obtaining a 180° angle at the start of the test. A starting angle of less than 180° can significantly change the peel speed and mostly lead to delamination from the support instead of the coating (tearing of paper base).

5.5 The variation in recording and laminating elements requires carrying out comparative tests under well-defined conditions.

5.6 Because these measurements concern surfaces, their condition is critical to the values obtained. Be sure to keep all print surfaces clean and free from contaminants, including fingerprints.

5.7 One of the most significant (and occasionally ignored) influences on peel values is the time that elapses from lamination until the test is performed. Values can change by 100 % depending on this "aging." Peel tests intrinsically produce quite a bit of data scatter from test to test. Keep a close watch on the results to be sure that your results are truly representative of your materials. Kinetic Peak and Valley provide important information about uniformity of lamination of the tested specimen.

5.8 Paper media have a tendency to tear the support after initial delamination from the bonding interface. It is well documented that at the same coat weight of ink receiving material, lighter paper media have higher tendency to support failure than heavier ones. Static Peak can be very useful in evaluation lamination performance of paper media. It is recommended to use Static Peak values to compare media having paper base failure. Additionally, it can also be used in evaluating media having delamination from the bonding interface. Media having paper failure but high Static Peak values are considered superior than media delaminated from the bond interface but having low peel strength.

5.9 Reducing laminating temperature could eliminate paper media failure. Lower laminating temperature reduces bonding strength between media and the laminate. In most cases, paper failure occurs when the laminate bonding strength is very high.

PRINTING

6. Test Specimen

6.1 The substrate, method of printing, ink or toner lay down, and handling of printed specimens shall be consistent with their anticipated end use.

6.2 The test image may be generated with personal computer using drawing/graphics, or page layout software able to generate composite black, saved as print file for each printer/method of printing (contributing its unique ink and ink/receiver interactions that may impact lamination.) Each print file should have its filename, type, and version identified in the image area and a place for experimental notes, for example, time, printer, environmental conditions, operator. The printer setting and a trial print of each print file version should be archived.

6.3 The recommended test image should consist of three primary and three secondary color strips (25.4 by 215.9 mm) plus a non-printed strip (25.4 by 215.9 mm). The colors should be printed in parallel in the following order: black (K), cyan, magenta, yellow, blue, green, red, white, composite black (C).

6.4 It is recommend to print in landscape mode having the 25.4-mm strips perpendicular to paper machine direction.

6.5 The test image used in comparison printers or inks (media laminated with the same film) should provide the same color elements.

7. Procedure

7.1 *Preparation of Printer*—When using an ink jet printer, print heads should be aligned, calibrated and checked for any nozzle clogging. Nozzle failure will reduce the ink lay down and can change peel strength.

7.2 The color strips printed should be generated using print files containing the appropriate printer setup specific for each application.

7.3 It is recommended that the color strip be printed as Postscript 3 file without color corrections using standard ink load limits or media selection. The printing mode is dependent on media type such as glossy photo, semi-glossy, paper bond, heavy-coated bond, and so forth.

7.4 Printing mode of the test image should be the same as recommended for media applications and available associated literature or a flyer.

7.5 Potential variables, such as temperature and relative humidity, must be monitored and controlled to guard against sample-induced changes.

7.6 Printing should be carried out at 23°C and 50 % relative humidity.

7.7 Printing can be done at extreme conditions such as 15°C, 20 % relative humidity and 38°C, 80 % relative humidity, but information about these conditions should be recorded with the lamination data.

8. Conditioning

8.1 It is recommended that samples be conditioned at 23°C and 50 % relative humidity for at least 24 h prior to printing and for at least 24 h subsequent to lamination. Specimens should be visually inspected for color uniformity and surface irregularities, which could adversely affect color densities and subsequently lamination.

8.2 The above conditioning step is pertinent only where media evaluation or comparison is needed. Obviously, as a production tool, the conditioning period is not practical. Therefore, when media are coated in production, the specimens should be obtained from each roll and checked as soon as possible in a repeatable procedure appropriate to the operation. It is imperative that operators use caution in selecting and preparing specimens to maintain good uniformity.

LAMINATION

9. Apparatus

9.1 A laminator used for continuous laminating, mounting and encapsulating. The laminator should have precise temperature control and different operating speeds to ensure that outgassing from inks does not effect adhesion or cause bubbles in the print. The laminator should:

9.2 Be capable of applying heat-activated or pressure-sensitive materials, or a combination of both.

9.3 Have an infinitely variable nip opening for all materials up to 40 mm (1.5 in.).

9.4 Have a digital or analog readout of speed.

9.5 Downward pressure and vacuum table are recommended.

10. Procedure

10.1 The print samples should be laminated 24 h after printing. The actual lamination time after printing should be presented in the report.

10.2 Before lamination, a strip of paper (50.8 by 216 mm) should be placed vertically on the top of a portion of the printed test pattern for each of the colors. About half of paper strip should cover the printed area and the other half should cover the unprinted area. This procedure allows the free end of the test specimen to be separated.

10.3 Laminating films that are 75 μ (3 mil) thick should be used for comparison purposes. Thicker films: 125, 175, and 250 μ (5, 7, and 10 mils) make it difficult to obtain the 180°C angle required in the test. At lower angles the film has a tendency to rip the support instead of delaminating from the coating. Films that are 25 or 50 μ (1 or 2 mil) thick have a tendency to elongate affecting the peel speed.

10.4 The temperature of the upper and lower rollers of laminator should be measured by infrared sensor and recorded. For precise measured and repeatability of the test, the difference between set up temperature and laminating rollers temperature should not be higher than ±5°C.

10.5 Speed of lamination for paper media having base weight in the range 90 to 170 gms should be 0.9 m/min (3 ft/min). Lower or higher speed can be used depending on film thickness, paper base weight, and lamination temperature.

10.6 Lamination pressure can be expressed as a half crank or bars (psi) value if a laminator is equipped with a gage.

10.7 The print should be placed centrally in the laminator to minimize temperature variation along the rollers.

10.8 The printed samples should be conditioned 24 h before lamination at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 %.

10.9 The laminations can be carried out in the office environment. However, samples printed and conditioned at different temperatures and humidities other than the ones above should be handled in sealed plastic bags and immediately laminated. This procedure preserves moisture in the media and provides reproducible tests.

DELAMINATION

11. Sampling and Specimen Preparation

11.1 *Materials*—Razor blade, single edge or cutting board. Cellophane tape, 25 mm (1 in.) wide, #610 "Scotch" brand or equivalent.

11.2 Using the specimen cutter, cut nine 215.9 by 25.4 mm (8.5 by 1 in.) specimens for each color and unprinted background from the test image.

11.3 Prepare three test specimens for each lamination condition.

12. Conditioning

12.1 Normally, condition all laminate specimens 24 h by exposure to a relative humidity of 50 ± 5 % at 23 ± 2°C (73.4 ± 3.6°F) to provide additional time for equilibration of adhesive containing interfaces.

12.2 The above conditioning step is pertinent only when doing comparative testing where laminate films and media evaluation or comparison is needed. Obviously, as a production tool, the conditioning period is not practical. Therefore, when laminate adhesion is measured in production, the specimens should be obtained from each laminate roll and checked as soon as possible in a repeatable procedure appropriate to the operation.

13. Apparatus

13.1 A constant-rate-of-extension (CER) tension tester: available from Instrumentors, Inc. Strongville, OH, adequate load range to handle all materials of this type, appropriate grips, and variable or at least 304.8 mm (12 in.) per minute test speed. The tester shall have two clamps (or one) with centers in the same plane, parallel with the direction of the motion of the stressing clam, and so aligned that they will hold the specimen wholly in the same plane.

13.2 Ensure that the peel tester is level.

13.3 Follow the manufacturer's instructions for zeroing and calibrating the peel tester and setting it to the proper speed and load range to properly measure the anticipated load.

13.4 The instrument shall be calibrated to an accuracy of 0.5 % of full scale and the readings are between 30 and 90 % of the full load range.

14. Procedure

14.1 The hardware setup for a typical 180° peel test is shown in Fig. 3.

14.2 The testing speed should be of 304.8 mm (12 in.) per minute, although higher speeds can be used for release force measurements.

14.3 Conduct testing as soon as possible after removal of the test specimens from the conditioning atmosphere and preferably under the same environmental conditions.

14.4 To maintain a separation rate of 304.8 mm (12 in.) per minute, specimens must be relatively non-extensible in the

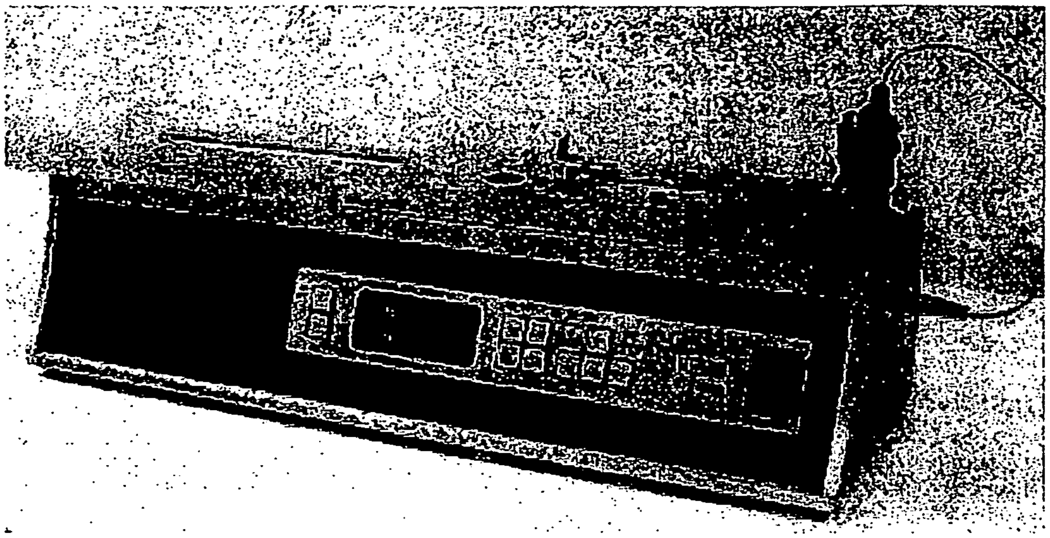

FIG. 3 Constant-Rate-of-Extension (CER) Tension Tester

expected loading range. Where a material is sufficiently extensible (that is, stretch is greater than about 15 %) to radically lower the stripping rate, reinforce the extensible member with 25.4 mm (1 in.) width non-extensible tape or change the thickness of laminating film. In reporting such a test, the backing material and method must be completely identified. It is recommended to use 3 mil laminating film for media evaluation.

14.5 Cohesive or adhesive failure may be determined by observation. Cohesive failure refers to failure in the adhesive or specimen material itself. Adhesive failure refers to the lack of adherence between materials.

14.6 Paper strips placed on top of the test image before lamination allow the free ends to be separated from the test specimen (by hand) for a distance of approximately 51 mm (2 in.). It is not recommended to initiate delamination by pulling the coating from the substrate or separating the plies of the lamination.

14.7 Place the specimen in the tester by clamping the free end of the film with the protective paper in the grip. Attach the free end of the print to the platform by pressure-sensitive tape. The peel strength of the tape has to be higher than the peel strength of the test specimen.

14.8 Align the free ends of the specimen symmetrically in the grips so that the tension is distributed uniformly.

14.9 During the actual peel test procedure, it takes a small, but finite, amount of time for the peel forces to reach a dynamic equilibrium. The selectable Delay Time for the instrument inhibits the measurement of kinetic peak, valley, average and PMS values during the Delay Time. For most standards work, a delay of 1 or 2 seconds is satisfactory. For higher speeds, a 1 second may "waste" too much of the sample.

14.10 Begin the test. After the platform starts moving, and at the end of your selected Delay Time, the Averaging light will come on, persisting for the length of time that you selected as Average Time.

14.11 At the end of that time, the platen will stop (depending on how you set up the (Platen Stop Mode) and the Results screen will display the test data.

14.12 Observe the peel force over a separation distance of at least 101.6 mm (4 in.) or the average time of at least 10 s. However, the time of 20 s is recommended. Then stop the tester and return the movable grip to its starting position. Remove the tested specimen.

14.12.1 The Average Time that you use will be dependent on the testing speed, the sample length, and, in certain instances, how much test time you can budget for each test. For lamination work, 10 s Average Time is a good value to start out with.

14.13 If the RMS is higher than 10 % of average load, the test should be repeated.

14.14 Repeat steps 14.3-14.12 with remaining specimens.

15. Interpretation of Results

15.1 Determine the peel or stripping strength for each specimen in Newtons per meter (or grams per 1 in.) width. For standard 25.4 mm width specimens, the peel value is equal to the recorded load. The average peel over the entire separation distance is the generally preferred value.

15.2 For each series of specimens, calculate the arithmetic average of all of the values obtained as the average for each color specimen and unprinted one.

15.3 Root-Mean-Square (RMS) is calculated according to the following formula:

$$RMS = \sqrt{\frac{\sum_{1}^{n} (L_N - L_{AVG})}{N}} \tag{1}$$

where:

L_N = instantaneous force sample,
L_{AVG} = previously determined mean of all N readings, and
N = total number of data samples.

NOTE 1—The type of equipment used to determine peel strength must be stated.

16. Report

16.1 Report the following information:

16.1.1 Specimen identification, including the printer, method of printing, and the media type.

16.1.2 Lamination temperature, speed, applied pressure on nip, relative humidity and temperature in the room, where lamination is carried out, and time after printing.

16.1.3 Individual test loads.

16.1.4 Average peel or stripping strength in Newtons per meter (or grams per 1 in.) width for each color and the unprinted area.

16.1.5 Type of failure (see 4.6).

16.1.6 In the case of paper failure the value of static peak should be also reported.

16.1.7 Any unusual characteristics. Include backing if required and the conditioning cycle if other than standard.

17. Precision and Bias

17.1 A statement of bias is not applicable in view of the unavailability of a standard reference for these properties.

18. Keywords

18.1 accelerate aging; adhesion; bond strength; debonding; delamination; encapsulating; high temperature laminates; ink jet; lamination; low temperature laminates; media; mounting; peel strength; pressure-sensitive laminates; printing; thickness